

# Worksheet: Exact Differential Equations



**Q1:** Is the differential equation  $(x + \tan^{-1} y) dx + \left(\frac{x + y}{1 + 3y^2}\right) dy = 0$  exact?

A no

B yes

**Q2:** Solve the exact differential equation  $(2xy^2 + 3x^2) dx + (2x^2y + 4y^3) dy = 0$ .

A  $x^2y^2 + x^3 = C$

B  $2x^2y^2 + x^3 + y^4 - \frac{2}{3}xy^3 - 3x^2y = C$

C  $x^2y^2 + x^3 + 2x^2y + 4y^3 - 2xy^2 = C$

D  $x^2y^2 + x^3 + 4y^3 = C$

E  $x^2y^2 + x^3 + y^4 = C$

**Q3:** Solve the exact differential equation  $(1 + ye^{xy}) dx + (2y + xe^{xy}) dy = 0$ .

A  $x + e^{xy} + 2y = C$

B  $x + e^{xy} + y^2 = C$

C  $x + e^{xy} = C$

D  $x + y^2 - y + \left(2 + \frac{1}{x}\right) e^{xy} = C$

E  $x + 2y + (2 + x) e^{xy} = C$

**Q4:** Is the differential equation  $\left(\frac{2x^{\frac{5}{2}} - 3y^{\frac{5}{3}}}{2x^{\frac{5}{2}}y^{\frac{2}{3}}}\right) dx + \left(\frac{3y^{\frac{5}{3}} - 2x^{\frac{5}{2}}}{3x^{\frac{3}{2}}y^{\frac{5}{3}}}\right) dy = 0$  exact?

A no

B yes

**Q5:** Is the differential equation  $\left(x^3 + \frac{y}{x^2}\right) dx + (y^2 + \ln 5x) dy = 0$  exact?

A no

B yes

**Q6:** Solve the exact differential equation  $(\cos x + \ln y) dx + \left(\frac{x}{y} + e^y\right) dy = 0$ .

A  $-\sin x + x \ln y = C$

B  $-\sin x + x \ln y + e^y = C$

C  $-\sin x - x \ln y + e^y = C$

D  $\sin x + x \ln y + e^y = C$

E  $\sin x + x \ln y = C$

**Q7:** Solve the exact differential equation  $\left(\frac{2x^{\frac{5}{2}} - 3y^{\frac{5}{3}}}{2x^{\frac{5}{2}}y^{\frac{2}{3}}}\right) dx +$

$\left(\frac{3y^{\frac{5}{3}} - 2x^{\frac{5}{2}}}{3x^{\frac{3}{2}}y^{\frac{5}{3}}}\right) dy = 0$ .

A  $-\frac{2}{3}y^{-\frac{5}{3}} + x^{-\frac{3}{2}} = C$

B  $-\frac{2}{3}xy^{-\frac{5}{3}} + x^{-\frac{7}{2}} = C$

C  $xy^{-\frac{2}{3}} + \frac{7}{2}yx^{-\frac{7}{2}} = C$

D  $y^{-\frac{2}{3}} + yx^{-\frac{3}{2}} = C$

E  $xy^{-\frac{2}{3}} + yx^{-\frac{3}{2}} = C$

**Q8:** Solve the exact differential equation  $(x^3 + \frac{y}{x}) dx + (y^2 + \ln x) dy = 0$ .

A  $\frac{x^4}{4} + y \ln x + y^2 - x^3 = C$

B  $\frac{x^4}{4} + 2y \ln x + \frac{y^3}{3} - x^3y - \frac{y^2}{2x} = C$

C  $\frac{x^4}{4} + y \ln x + y^2 = C$

D  $\frac{x^4}{4} + y \ln x + \frac{y^3}{3} = C$

E  $\frac{x^4}{4} + y \ln x = C$

**Q9:** Solve the exact differential equation  $(x + \tan^{-1} y) dx + (\frac{x + y}{1 + y^2}) dy = 0$ .

A  $2x^2 + x \tan^{-1} y + \frac{y}{1 + y^2} = C$

B  $\frac{x^2}{2} + x \tan^{-1} y + \frac{y}{1 + y^2} = C$

C  $\frac{x^2}{2} + x \tan^{-1} y + \frac{\ln(1 + y^2)}{2} = C$

D  $\frac{x^2}{2} + x \tan^{-1} y = C$

E  $\frac{x^2}{2} + x \tan^{-1} y + \ln(1 + y^2) = C$

**Q10:** Is the differential equation  $(3x^2 + 2y^2) dx + (4xy + 6y^2) dy = 0$  exact?

A No

B Yes

**Q11:** Find the general solution for the following exact differential equation:

$$\frac{1}{y} - \left(\frac{x}{y^2}\right) \frac{dy}{dx} = 0.$$

A  $y = x + c$

B  $y = c\sqrt{x}$

C  $y = \frac{x}{c}$

D  $y = \frac{c}{x}$

**Q12:** Solve the exact differential equation  $(6xy - y^3) dx + (4y + 3x^2 - 3xy^2) dy = 0$ .

A  $4xy + x^3 - \frac{3}{2}x^2y^2 + 2y^2 = C$

B  $3x^2y - xy^3 = C$

C  $4xy + x^3 - \frac{3}{2}x^2y^2 + 4y = C$

D  $3x^2y - xy^3 + 2y^2 = C$

E  $3x^2y - xy^3 + 4y = C$

**Q13:** Solve the exact differential equation  $(2x + 3y) dx + (3x + 2y) dy = 0$ .

A  $x^2 + 3xy + 2y = C$

B  $x^2 + 3xy + y^2 = C$

C  $x^2 + 3xy = C$

D  $x^2 + 3xy + x - y = C$

E  $x^2 + 4xy - \frac{1}{2}y^2 = C$

**Q14:** Is the differential equation  $(2x + 3y) dx + (3x + 2y) dy = 0$  exact?

A no

B yes

**Q15:** Solve the exact differential equation  $y^3 dx + 3xy^2 dy = 0$ .

A  $2xy^3 - \frac{y^4}{4} = C$

B  $y^3 = C$

C  $xy^3 + \frac{3}{2}x^2y^2 = C$

D  $\frac{3}{2}x^2y^2 = C$

E  $xy^3 = C$

**Q16:** Solve the exact differential equation  $(e^x \sin y + \tan y) dx + (e^x \cos y + x \sec^2 y) dy = 0$ .

A  $e^x \sin y + x \tan y = C$

B  $e^x \sin y + x \tan y + 2e^x \cos y = C$

C  $2e^x \sin y + x \tan y = C$

D  $e^x \cos y + \frac{x^2}{2} \sec^2 y = C$

E  $e^x \cos y + \frac{x^2}{2} \sec^2 y - 2e^x \sin y = C$

**Q17:** Is the differential equation  $(\cos x + \ln y) dx + \left(\frac{x}{y} + e^y\right) dy = 0$  exact?

A yes

B no

**Q18:** Is the differential equation  $\left(\frac{2x}{y^2} - \frac{3y^2}{x^4}\right) dx + \left(\frac{2y}{x^3} - \frac{x^2}{y^2} + \frac{1}{\sqrt{y}}\right) dy = 0$  exact?

A yes

B no

**Q19:** Solve the exact differential equation  $\left(\frac{2x}{y} - \frac{3y^2}{x^4}\right)dx + \left(\frac{2y}{x^3} - \frac{x^2}{y^2} + \frac{1}{\sqrt{y}}\right)dy = 0$ .

A  $\frac{x^2}{y} + \frac{3y^2}{5x^5} + \frac{2}{\sqrt{y}} = C$

B  $\frac{x^2}{y} + \frac{y^2}{x^3} + 2\sqrt{y} = C$

C  $\frac{x^2}{y} + \frac{3y^2}{5x^5} + \frac{1}{\sqrt{y}} = C$

D  $\frac{x^2}{y} + \frac{y^2}{x^3} + \sqrt{y} = C$

E  $\frac{x^2}{y} + \frac{y^2}{x^3} = C$

**Q20:** Solve the exact differential equation  $(3x^2y^3 + y^4)dx + (3x^3y^2 + y^4 + 4xy^3)dy = 0$ .

A  $x^3y^3 + xy^4 + \frac{y^5}{5} = C$

B  $x^3y^3 + yx^3 = C$

C  $x^3y^3 + yx^4 + y^4 = C$

D  $x^3y^3 + yx^3 + \frac{y^5}{4} = C$

E  $x^3y^3 + yx^4 + 4y^3 = C$



**Q21:** Solve the exact differential equation  $(4x - y) dx + (6y - x) dy = 0$ .

A  $-2x^2 + (1 - x)y = C$

B  $2x^2 + (6 - x)y = C$

C  $-\frac{4}{3}x^3 + 2x^2 - xy + \frac{1}{2}y^2 = C$

D  $2x^2 - xy + 3y^2 = C$

E  $2x^2 - xy = C$

**Q22:** Solve the exact differential equation  $(3x^2 + 2y^2) dx + (4xy + 6y^2) dy = 0$ .

A  $x^3 + 2xy^2 + 2y^3 = C$

B  $4xy^2 + \frac{4}{3}y^3 = C$

C  $x^3 + 2xy^2 = C$

D  $x^3 + 2xy^2 + 4xy + 4y^2 = C$

E  $x^3 + 2y^2x + 6y^2 = C$